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**The Evolution of Mammography** 1
Richard H. Gold

The evolution of mammography can be arbitrarily subdivided into three periods: The Age of Pioneers highlights the work of Salomon, Kleinschmidt, Warren, Vogel, Seabold, Gershon-Cohen, Leborgne, Egan, Gallager, Martin, Dodd, Strax, and their colleagues; The Age of Technical Progress adds the names of Gould, Wolfe, and Gros, and their coworkers; The Modern Era reflects the contributions of Price, Butler, Ostrum, Becker, Isard, Moskowitz, Sickles, Kopans, Homer, Tabàr, and their associates. The ultimate success of mammography, the preeminent method of breast cancer screening, could not have been achieved without the intense vision, idealism, and scientific skill of its creators and nurturers.

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G. W. Eklund and Gilda Cardenosa

Optimal mammographic positioning is achieved by understanding and using the capabilities of available dedicated mammographic equipment and applying this understanding to take full advantage of natural breast mobility in overcoming various anatomic limitations. Creative problem solving techniques for imaging "seen-on-only-one-view" lesions, bedfast patients, or the augmented breast enable the mammographer to exercise true art in mammographic positioning. Optimal visualization of more breast tissue enhances the opportunity for earlier detection of more clinically occult, curable breast cancers.

**New and Future Developments in Screen-Film Mammography Equipment and Techniques** 55
Carolyn Kimme-Smith

High-frequency generators, automatic exposure control device improvements, new screen-film advantages, processor quality control, new mam-

mography phantoms, stereotactic devices, and digital mammography computer assisted diagnosis are reviewed in this article.

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Stephen A. Feig

This article discusses the mammographic, sonographic, and clinical features of various benign and malignant stellate and circumscribed masses and masslike densities. Imaging methods to evaluate the likelihood of malignancy are stressed. Particular attention is given to management considerations and guidelines for circumscribed masses. A protocol for evaluation of palpable masses is included.

**Mammographic Analysis of Calcifications** 93
Lawrence W. Bassett

Optimal depiction of calcifications requires dedicated mammography units with high output x-ray tubes, molybdenum targets, reciprocating grids, and microfocus magnification capabilities. Because extensive ductal carcinoma in situ and invasive cancers with extensive intraductal components may recur after breast-conserving surgery, wide excision with careful pathologic evaluation of the margins of the excised tissue and microfocus magnification mammography prior to radiotherapy are recommended. Evaluation of the mammographic features of calcification reduces the number of biopsies done for benign conditions.

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Ellen B. Mendelson

Postsurgical changes may overlap with radiographic features of malignancy, and mammographic evaluation may be difficult. Mammograms must be evaluated in temporal content and correlated with physical findings and the surgical procedures that have been performed. Most important are changes in the breasts after breast conservation therapy and the differentiation of post-treatment changes from recurrent tumor. Findings after benign biopsy and cosmetic and reconstructive procedures are also described. Guides for mammographic follow-up care of these patients and use of ancillary techniques are also proposed.

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Marc J. Homer, Thomas J. Smith, and Homa Safaii

Preoperative percutaneous needle localization of the nonpalpable mammographic abnormality requires a cooperative effort from the radiologist, surgeon, and pathologist. The frequency of performing this procedure will continue to increase as the number of screening mammograms increases. An unsuccessful needle localization may result in the delay of diagnosis of breast cancer. Every member of the team should understand his or her role in order to ensure a successful integrated effort.

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Fine needle aspiration biopsy (FNAB) is a promising technique for the evaluation of nonpalpable breast abnormalities. Mammographically detected lesions can be localized for FNAB by use of fenestrated coordinate-grid compression paddles or stereotactic devices. Despite the advantages of low cost and minimal discomfort for the patient, there are a number

of limitations with the current technology. Further research is necessary to determine the roles of percutaneous needle biopsy techniques in the diagnosis of nonpalpable breast lesions.

**Ultrasound-Guided Needle Biopsy of the Breast and Other Interventional Procedures** 167
Bruno D. Fornage, John D. Coan, and Cynthia L. David

The techniques of and indications for ultrasound-guided needle biopsy of nonpalpable breast lesions are described. High-frequency ultrasonography offers several distinct advantages over sterotaxy and is the technique of choice for guiding the drainage of cysts and fluid collections and the biopsy of any solid mass that can be identified on sonograms. Ultrasonography also can be used for localizing such lesions preoperatively.

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Làszlò Tabàr, Gunnar Fagerberg, Stephen W. Duffy, Nicholas E. Day, Adel Gad, and Otto Gröntoft

The results of the Swedish two-county study of mammographic screening are updated to the end of 1990. The major result of the trial in terms of breast cancer mortality remains stable at an approximate mortality reduction of 30% in association with screening. Examination of tumor attributes indicates that a large proportion of the benefit of screening is achieved through the effect of screening in reducing tumor size, grade, and rates of lymph node metastases at diagnosis. For a screening program to be effective, invasive cancers must be detected while they are small, preferably less that 15 mm in diameter. This can be achieved in specialist screening centers by careful planning, training of personnel, and ongoing monitoring of screening quality.

**A Screening Mammography Program: Staying Alive and Making It Work** 211
Barbara S. Monsees and Judy M. Destouet

Less than half of the 50 million women of screening age in the United States have ever had a mammogram, and even fewer undergo routine screening. Recognizing that cost and inaccessibility are among the reasons for limited compliance with the American Cancer Society screening guidelines, radiology practices have begun to offer affordable and convenient screening. Some of the important features of successful programs are described.

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Myron Moskowitz

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**The Politics of Mammography** 235
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A medical audit produces the clinical data that indicate the success or failure of a mammography practice in detecting otherwise occult breast cancer. Such an audit is just as essential a part of quality assurance as are evaluations of equipment, imaging, and image processing. This article describes how to conduct a medical audit, reports sample audit results, and discusses how to interpret audit data and use them for the benefit of patients, referring physicians, third-party payers, and mammography personnel.

**Medicolegal Aspects of Breast Imaging** 277
R. James Brenner

The increasing use of mammography by women in this country provides both opportunity and challenge to radiologists. Fundamental notions of diagnostic radiology need to be altered in this context. Highly efficient low-cost facilities are needed in screening mammography, while more dedicated and deliberate approaches are involved in diagnostic mammography. Different reimbursement schedules and different legal liability exposure follow as a natural consequence of the related but nonetheless separate endeavors. A clear definition of such different efforts and associated planning will allow given radiologic practices a sound legal basis in either or both endeavors.

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**The Radiology of Chest Trauma** 291
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This article deals in broad terms with the radiologic manifestations of chest trauma. Skeletal injuries are not covered in depth to allow more attention to be paid to the intrathoracic consequences of trauma. Attention is also paid to the indirect effects of trauma, for example, to fat embolism.

**Emergent Radiologic Evaluation of the Gunshot Wound Victim** 307
C. Douglas Phillips

The incidence and number of victims of gunshot injury in the United States increases yearly. Rapid acute assessment of these individuals includes radiologic examinations. This article is an overview of current management practices and information relevant to the radiologist who is called upon to evaluate these patients.

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Michele H. Johnson and S. Howard Lee

Hounsfield's development of computed tomography (CT) in 1972 revolutionized the care of patients with acute craniocerebral trauma. CT evaluation facilitates early surgical and medical intervention and has significantly improved patient outcome. This review describes the role of CT in assessing acute head trauma. Despite the growing role of magnetic resonance imaging in the acute, subacute, and chronic phases of brain injury as well as in many other central nervous system disorders, CT retains its unique capacity to image acutely ill patients rapidly and accurately.

**Magnetic Resonance Applications in Cerebral Injury** 353
Evelyn M. L. Sklar, Robert M. Quencer, Brian C. Bowen, Nolan Altman, and Philip A. Villanueva

Many abnormalities in patients with head injuries, such as diffuse axonal injury, cortical contusions, and small subdural hematomas, are identified

by magnetic resonance (MR) imaging but may not be seen by computed tomography (CT). When rapid assessment of the brain is required, particularly in acute trauma, CT still remains the imaging procedure of choice. MR angiography can play an important role in the diagnostic evaluation of the trauma patient because vascular injuries can be identified. In the pediatric age group, MR is particularly useful in evaluating head injury due to child abuse.

**Computed Tomographic Evaluation of Blunt Abdominal Trauma** **367**
Spencer B. Gay and Christopher L. Sistrom

Computed tomography (CT) plays an integral part in the management of patients sustaining blunt abdominal trauma. Although CT is needed in only a minority of such patients it provides an accurate diagnosis of most intra-abdominal injuries. Considerable debate has arisen over the relative sensitivities of CT and diagnostic peritoneal lavage in detecting subtle injuries. This article presents a scanning protocol and interpretive advice that should help radiologists provide timely and accurate diagnoses from CT scans done for blunt trauma to the abdomen.

**Ultrasonography of the Acute Abdomen** **389**
Faye C. Laing

During the past decade, noninvasive imaging has assumed an increasingly prominent role in the evaluation of patients who have acute abdominal conditions. Ultrasonography is often the initial diagnostic imaging modality used to examine patients who are clinically suspected of having acute cholecystitis, choledocholithiasis, and acute appendicitis. This article focuses on the clinical considerations and the ultrasonographic findings that relate to each of these conditions. In addition to describing the ultrasonographic appearances for each of these entities, this article also emphasizes useful scanning techniques that will provide optimal images.

**Perforation and Obstruction of the Gastrointestinal Tract: Assessment by Conventional Radiology** **405**
Hubert A. Shaffer, Jr

Plain film radiography of the abdomen is a relatively sensitive and cost-effective screening procedure for detecting spontaneous perforation and mechanical obstruction of the gastrointestinal tract. The diagnostic signs are numerous and often subtle. Accurate radiologic interpretation relies on prior knowledge of the signs and careful analysis of the films. Determination of the site and specific etiology of the problem may require a follow-up diagnostic procedure such as a gastrointestinal contrast examination.

**Interventional Radiology of Trauma** **427**
J. Bayne Selby, Jr

The interventional radiologist has become an indispensable member of the trauma team. This article reviews general therapeutic embolization techniques and then applies them to trauma involving different parts of the vascular tree. The manpower and equipment requirements necessary to provide this service are identified. The need for rapid response time when called upon is stressed.

**The Child with Acute Abdominal Pain and Vomiting** **441**
Bennett A. Alford and Joan McIlhenny

Evaluation of the child who presents with abdominal pain and vomiting is difficult. Close cooperation among pediatricians, surgeons, and radiol-

ogists is necessary to identify situations requiring urgent intervention. We discuss imaging evaluation of malrotation, hypertrophic pyloric stenosis, intussusception, and appendicitis.

**Emergency Nuclear Medicine** **455**
Jayashree S. Parekh and Charles D. Teates

Nuclear medicine is unique among imaging procedures because it permits noninvasive functional evaluation of various organ systems. This article discusses the use of scintigraphy in various emergency conditions such as acute gastrointestinal bleeding, hepatobiliary symptoms, acute renal failure, testicular pain, and one specific area of skeletal trauma. Although the ventilation/perfusion scan probably remains the dominant emergency study in most hospitals, other procedures discussed in this article play an important role in acutely ill patients.

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Hans Olav Riddervold

This article reviews easily missed fractures. Spinal fractures predominate in the discussion, but fractures of the chest/upper extremity and pelvis/lower extremity also are included. Ample illustrative radiographs are provided.

**Medicolegal Aspects of Emergency Department Radiology** **495**
Phillip C. Stone and Charles F. Hilton

This article reviews the current legal environment in which radiologists practice medicine and some of the key problems radiologists may experience. Particular attention is given to the need for accurate communication, complete charting, and carefully performed procedures. Information is also provided about the requirements for informed consent. Recommendations are made for dealing with patient grievances and with patients' attorneys after a lawsuit has arisen.

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**Immune Function and Dysfunction: A Primer for the Radiologist** 507
Joshua T. Rubin and Michael T. Lotze

Effective immune responses represent the harmonious interaction of many different humoral and cellular effectors. As long as this system remains intact, we are protected from fulminant infection, autoimmunity, and malignancy. The radiologic manifestations of immune dysfunction are those associated with inflammation, such as edema; infection, such as abscess or infiltrate; and malignancy, such as tumor. This article describes the components of the immune system with reference to how they interact in periods of health and how their derangement in the immunocompromised patient may lead to disease.

**Thoracic Disease in the Immunocompromised Patient** 525
Theresa C. McLoud and David P. Naidich

Thoracic disease in the HIV negative immunocompromised host is most frequently caused by infection. Patterns of involvement produced on the chest radiograph include (1) lobar or segmental consolidation, (2) nodules with rapid growth and/or cavitation, and (3) diffuse lung disease. The lung also may be directly involved by lymphoma, metastases, drug reactions, radiation pneumonitis, or nonspecific interstitial pneumonitis. The lung is a frequent target organ for opportunistic infections in AIDS patients, particularly of *Pneumocystis carinii* pneumonia and tuberculosis. Computed tomography may be particularly helpful in these patients in the detection of early disease and in the characterization of patterns and extent of involvement as well as complications.

**Gastrointestinal Disease in the Immunocompromised Host** 555
Bronwyn Jones and Susan D. Wall

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sarcoma, lymphoma and other B cell proliferative disorders, cancer following transplantation, typhlitis, and pseudomembranous colitis.

**Abdominal Imaging in the Immunocompromised Patient** 579
R. Brooke Jeffrey, Jr

Abdominal and gastrointestinal disease may result in clinically important complications in immunocompromised patients. The major types of disease are opportunistic infections and immunodeficiency-associated neoplasms. A multimodality approach is often essential in the diagnosis and staging of these lesions. A combination of bacteriologic culture, endoscopy, barium studies, and cross-sectional imaging of the abdomen with computed tomography and sonography is required to assess the extent of the disease accurately.

**Thoracic and Abdominal Manifestations of Lymphoma Occurring in the Immunocompromised Patient** 597
Gerald D. Dodd III, Daniel P. Greenler, and Scharmen R. Confer

Organ transplant and AIDS patients are at increased risk for developing non-Hodgkin's lymphomas. These lymphomas are more aggressive, exhibit an increased frequency of extranodal disease, and are associated with a worse prognosis than lymphomas occurring in immunocompetent patients. Early radiologic diagnosis of these tumors can have a significant impact on prognosis.

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Charles Davenport, William P. Dillon, and Gordon Sze

In recent years, one of the most common reasons for neuroimaging has become the evaluation of the immunosuppressed patient. In this review the radiographic appearances of the common inflammatory and neoplastic conditions affecting the central nervous system in patients with HIV infection, as well as the AIDS-dementia complex, are discussed. Non-AIDS immunocompromised neurologic disease is also examined, with particular emphasis on the effect of various immunosuppressive medications on the brain and spine.

**Opportunistic Infections and Tumors in Immunocompromised Children** 639
Michael M. Ambrosino, Nancy B. Genieser, Keith Krasinski, M. Alba Greco, and William Borkowsky

Immune deficiency has become one of the primary diseases seen by pediatric radiologists practicing in large cities. The salient clinical and radiologic features of immunocompromised children are reviewed.

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**Transvaginal Sonography of Normal Pelvic Anatomy** 663
E. A. Lyons, Denis Gratton, and Chris Harrington

Sonographic imaging of the female pelvis has advanced rapidly since the introduction in 1985 of high frequency transvaginal probes. Transvaginal sonography (TVS) affords superior image resolution compared to the traditional transabdominal scanning approach. Structures such as the endometrium and ovary are seen with excellent detail, which permits more precise interpretation of normal and pathologic states. In this article, we describe TVS of the normal female pelvic anatomy, with emphasis on its present clinical usefulness and limitations.

**Transvaginal Sonography of Adnexal Masses** 677
Beverly G. Coleman

Transvaginal sonography affords improved resolution of the adnexa in numerous gynecologic conditions. It can provide important diagnostic information regarding the internal acoustic characteristics, size, site of origin, and precise relationship of adnexal masses to other pelvic organs. This procedure is best utilized as an adjunct to conventional ultrasound in the evaluation of the female pelvis.

**Conventional and Color Doppler Transvaginal Sonography in Gynecologic Infertility: Current Clinical Applications** 693
Arthur C. Fleischer, Donna M. Kepple, and Jaime Vasquez

Transvaginal sonography (TVS) has had a tremendous impact upon the diagnosis of gynecologic disorders in infertility patients. It is now recognized as the procedure of choice for monitoring follicular development, assessing the endometrium, and guiding follicular aspiration. With the addition of color Doppler imaging to the vaginal probe, other applications being investigated include the evaluation of uterine and adnexal perfusion in early pregnancy, corpus luteal adequacy, torsion, and ectopic pregnancy.

**Transvaginal Ultrasonography of Pelvic Neoplasms** 703
Ellen B. Mendelson and Marcela Böhm-Vélez

The recent development of the high resolution transvaginal probe has increased the diagnostic sensitivity and specificity of transabdominal sonography. This article reviews the applications of transvaginal sonography with pulsed and color flow Doppler imaging to the diagnosis and management of uterine, ovarian, and metastatic pelvic neoplasms.

**Doppler Ultrasonography of the Pelvis** 735
Vicki L. Schiller and Edward G. Grant

Transvaginal color Doppler imaging has exposed new and important avenues of vascular research within the female pelvis. Hormone mediated vascular changes seen during the menstrual cycle and in normal and abnormal early pregnancy are being studied and documented. Color Doppler imaging is becoming an important adjunct to many facets of infertility work, and Doppler spectral analysis is being used to distinguish benign from malignant masses within the uterus and adnexa.

**Ultrasonography of the Female Pelvis in Childhood and Adolescence** 743
Rita Littlewood Teele and Jane Chrestman Share

The female patient is first a baby, next a child, and then an adolescent. Different problems affect each age group. This article discusses the ultrasonographic features of the normal pelvis at each stage of development and the common problems that affect the gynecologic organs in childhood.

**Transvaginal Ultrasonography in Postmenopausal Patients** 759
Peter H. Arger

Transvaginal sonography (TVS) has greatly added to the diagnostic evaluation of postmenopausal gynecologic problems. The uterus and the ovaries frequently are better visualized, thus allowing unsuspected abnormalities to be diagnosed. Follow-up monitoring of benign abnormalities can be easily performed with TVS. This technologic advance in ultrasonographic imaging is a significant step forward in our ability to help patients with symptoms related to the pelvis.

**Magnetic Resonance Imaging of the Normal Female Pelvis** 769
Shirley McCarthy

Magnetic resonance (MR) imaging has enabled a new appreciation of the normal anatomy of the female pelvis. A characteristic zonal architecture of the corpus, cervix, and vagina is defined on T2-weighted images. The junctional zone, a low signal band that surrounds the endometrium, represents a layer of compact myometrium. Ovarian follicles and stroma are also readily delineated with MR imaging.

**Benign Disease of the Uterus and Ovaries: Applications of Magnetic Resonance Imaging** 777
Donald G. Mitchell

Magnetic resonance (MR) imaging can contribute to cost-effective management in women who have suspected myomas or adenomyosis and can provide precise presurgical mapping prior to myomectomy or correction of müllerian duct anomalies. MR imaging is also valuable in patients who have suspected adnexal masses that are not detected sonographically or when definitive diagnosis of juxtauterine myoma, cystic teratoma, or hemorrhagic mass may alter management.

**Evaluation of Gynecologic Malignancy by Magnetic Resonance Imaging** 789
Eric Outwater and Herbert Y. Kressel

Magnetic resonance (MR) imaging has demonstrated ability in the identification, characterization, and staging of some types of gynecologic malignancy and shows promise for eventually supplanting some staging procedures. Current techniques can address clinical issues related to treatment response and complications. Innovations in the areas of surface coil technology and fast scan pulse sequence will improve the capability of MR imaging to comprehensively evaluate pelvic tumors in women.

**Magnetic Resonance Imaging of the Pediatric Pelvis** 807
M. Ines Boechat

Magnetic resonance (MR) imaging is an important problem solving tool in the evaluation of pelvic disease in the pediatric population. The main indications for MR imaging include the diagnosis and staging of neoplasms and the investigation of complex congenital anomalies. The technique and limitations of the examination as well as normal variations are emphasized.

**Computed Tomography of Gynecologic Neoplasms** 817
James W. Walsh

Computed tomography (CT) maintains a strong role in female genital tract imaging because of its cost effectiveness; high spatial resolution; fast examination time for the pelvis, abdomen, and/or chest; and wide availability. CT is more accurate in demonstrating advanced disease and is most efficacious in evaluating patients who have an equivocal pelvic examination and in staging poorly differentiated cancers, which have a higher propensity for metastases. CT is particularly advantageous for lymph node metastasis screening and guided needle biopsy. CT is currently recommended for primary staging of ovarian cancer and advanced cancers of the cervix and endometrium, detection of persistent and metastatic gestational trophoblastic disease, and evaluation of recurrent gynecologic pelvic cancers.

**Computed Tomographic Evaluation of Benign and Inflammatory Disorders of the Female Pelvis** 831
Jill E. Langer and Barbara J. Dinsmore

The use and importance of computed tomography (CT) in the evaluation of patients with inflammatory conditions of the pelvis has increased in recent years. Although its role may be limited in women of childbearing age, CT may provide definitive diagnostic information concerning benign pelvic masses frequently present in this age group. CT is particularly valuable in detecting complications in the postpartum and postoperative pelvis. In patients who have known or suspected inflammatory conditions of the bowel, CT is the imaging modality of choice to identify extraluminal complications, such as abscess formation. CT is frequently diagnostic in diverticulitis and appendicitis and is of recognized value in guiding percutaneous drainage procedures, often sparing emergent surgical intervention.

**Computed Tomography and Magnetic Resonance Imaging of the Female Lower Urinary Tract** 843
Lisa Klein and Howard M. Pollack

Computed tomography (CT) and magnetic resonance (MR) imaging have become invaluable imaging modalities in the diagnosis of diseases involv-

ing the lower urinary tract. Both CT and MR imaging are able to accurately stage bladder carcinoma, with MR imaging able to distinguish between superficial and deep muscle invasion of tumor. CT and MR are also the studies of choice for evaluating retroperitoneal fibrosis, which often affects the urinary tract; MR imaging is often able to detect the presence of active inflammation and occasionally rule out a malignant cause. MR imaging holds promise for the evaluation of stress urinary incontinence and urethral disease. Although diseases of the distal ureter continue to be most accurately diagnosed by intravenous urography and retrograde studies, CT and MR imaging may serve a helpful secondary role.

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**Arterial Vascular Ultrasonography** 865
Kenneth J. W. Taylor

This article summarizes current applications of ultrasonography in the imaging of superficial vessels. These include color flow imaging of the carotid arteries and femoral vessels. The latter allows selection of patients for angioplasty and noninvasive surveillance of arterial grafts. With this technique, the complications of dialysis access grafts can be diagnosed. Pseudoaneurysms may now be diagnosed noninvasively and treated by compression. Finally, organic causes of impotence can be investigated and divided into those resulting from arterial insufficiency or venogenic causes.

**Venous Ultrasonography** 879
Gary S. Dorfman and John J. Cronan

Compression ultrasonography supplemented by pulsed and color Doppler imaging is the diagnostic modality of choice for evaluating lower extremity deep vein thrombosis in symptomatic and asymptomatic high-risk patients. Furthermore, this technique frequently can characterize the clot as occlusive or nonocclusive or acute or chronic and can define the extent of disease. In patients without thrombosis, this modality can suggest an alternative diagnosis in 12% of patients.

**Current Status of Intravascular Ultrasonography** 895
Barry T. Katzen

Intravascular ultrasonography provides unique diagnostic information about vessel wall structure and underlying disease. It has been shown to be superior in both the detection of atherosclerotic plaque and in the quantification of extended disease. Future applications will include three-dimensional ultrasound and integration into interventional devices. It has been of particular clinical value in the performance of percutaneous atherectomy and intravascular stent deployment.

**Musculoskeletal Ultrasonography** 907
Marnix van Holsbeeck and Joseph H. Introcaso

The scope of musculoskeletal ultrasound has been greatly broadened in recent years largely because of the advances in instrument technology. This article provides a brief overview of the spectrum encompassed by musculoskeletal ultrasound today. Current application of ultrasonography to the evaluation of muscles, tendons, bursae, ligaments, joints, bone, periosteum, and subcutaneous and periarticular soft tissues is reviewed.

**Ultrasonography of the Shoulder** 927
William D. Middleton

Shoulder sonography has been shown to be an effective noninvasive means of detecting rotator cuff tears and biceps tendon abnormalities. The examination requires careful attention to technique and a thorough knowledge of normal gross and sonographic anatomy. Rotator cuff tears generally cause a diffuse or focal decrease in the space between the humeral head and the deltoid muscle. Therefore, tears are easiest to detect by noting abnormally close apposition of the deltoid and humeral head.

**Ultrasonography of the Neck** 941
Luigi Solbiati, Vincenzo Cioffi, and Enrico Ballarati

The anatomic and pathologic involvement of the structures in the neck can be accurately studied with small parts ultrasonography. The thyroid and parathyroid glands and nodal chains are treated in this article; masses of the neck spaces are not considered because of their relative rarity.

**Transvaginal Ultrasonography** 955
Maija G. Freimanis and Anne F. Jones

Because of its closer proximity to the pelvic organs and its higher insonating frequency, transvaginal ultrasound provides improved anatomic image resolution and better tissue characterization than the transabdominal approach. Cyclic endometrial changes can be correlated with serum estradiol, follicular maturation, and successful embryo implantation in infertility patients. Endometrial hyperplasia and carcinoma in postmenopausal women present as inhomogeneous endometrial thickening. Differentiation of adnexal cysts, abscesses, masses, dilated tubes, and pelvic veins is facilitated by transvaginal imaging with Doppler ultrasound. Interventional procedures such as oocyte retrieval, cyst aspiration, ectopic pregnancy ablation, embryo reduction, and abscess drainage are easier and safer when using transvaginal probes.

**Smaller Parts Scanning of the Fetus** 977
Jason Birnholz

Fetal ultrasound studies are prospective clinical, physical examinations tailored to each patient. Every fetal study addresses several interrelated fetal and maternal issues, with equal emphasis on identifying problems and confirming clinical normality. To perform a thorough clinically directed examination, it is essential to know the range of pathologic changes that may occur, to appreciate normal anatomy, and to have models in mind that encompass physiologic and behavioral interactions. Although ultrasonography is an anatomic imaging method, the fetal examination goes beyond morphology, with correlative physiologic inference and clinical prediction.

**Breast Ultrasonography** 993
Peter M. Jokich, Debra L. Monticciolo, and Yolanda T. Adler

Breast ultrasonography is not useful in screening for breast cancer but is used primarily as an adjunct to mammography. In young women and in certain clinical settings, however, it may be the only modality used in the breast imaging examination. Its main goal is to differentiate cystic from solid lesions, and in particular, to confirm or exclude the diagnosis of a simple cyst. A variety of breast lesions and the technical factors necessary for adequate imaging are discussed. Ancillary uses of ultrasonography and the role of Doppler are also considered.

**Selected Topics in Pediatric Ultrasonography—1992** 1011
Sandra K. Fernbach and Kate A. Feinstein

Ultrasonography has been used increasingly to detect and evaluate congenital and acquired lesions in the pediatric patient. It is replacing other modalities in the evaluation of genitourinary problems, many of which are detected antenatally. Dynamic gastrointestinal processes such as gastroesophageal reflux can be observed. Bowel wall thickness, bowel loop size, and peristalsis are readily seen. Pyloric stenosis and intussusception, formerly diagnosed with barium studies, can be diagnosed with ultrasound. Appendicitis, a common problem in children, also can be diagnosed or excluded. Musculoskeletal applications are numerous and include detection of joint effusions, demonstration of the normal or abnormal development of the neonatal hip, and identification of soft tissue hematomas or abscesses. In children, the use of ultrasound in the neck and chest is expanding, with the Doppler technique being used quite differently than in adults.

**Recent Advances in Sonography of the Testis and Scrotum** 1033
Rick Feld and William D. Middleton

Scrotal sonography has shown utility in distinguishing intratesticular from extratesticular lesions as well as in characterizing cystic, solid, and complex lesions. Advances in technology, particularly with the addition of duplex Doppler and color Doppler ultrasound, have added information to the diagnosis of testicular and scrotal conditions. This article focuses on recent advances in gray scale and Doppler ultrasound of the testis and scrotum, with particular attention to inflammatory disease, ischemia, and neoplasm.

**Ultrasonographic Evaluation of Renal Transplantation** 1053
Myron A. Pozniak, Gerald D. Dodd III, and Frederick Kelcz

Ultrasonographic imaging and Doppler evaluation of the renal transplant maintains its role as a screening procedure for transplant dysfunction. Identification of fluid collections, hydronephrosis, or lymphoceles can focus timely surgical treatment. Although the predictive value of Doppler in acute rejection has faltered, the ability of Doppler to identify significant renal vasculature complications warrants spectral and color Doppler evaluation of any transplanted kidney that has compromised function.

**Endoscopic Ultrasonography of the Upper Gastrointestinal Tract** 1067
Jose F. Botet and Charles Lightdale

Endoscopic ultrasonography combines the advantages of conventional endoscopy with the capabilities of ultrasonography. This permits the examiner to see through the wall of the gastrointestinal tract. The close

proximity permits the use of relatively high frequencies, with the resulting increase in tissue contrast and resolution. There are limitations to its use, however, with the main one being a field of view limited to a 7-cm radius. Discussed in this article is its use for the gastrointestinal wall, the esophagus, the stomach, the duodenum, and the pancreas.

**Intraoperative Ultrasonography** **1085**
Junji Machi and Bernard Sigel

Four major benefits of intraoperative ultrasonography (IOU) were determined after its use in more than 2400 operations. They are the acquisition of new information not otherwise available, complement of or replacement for operative radiography, guidance of surgical procedure, and confirmation of completion of operation. IOU also has the advantages of safety, speed, higher accuracy, acquisition of more information, and wider application over operative radiography. Intraoperative color Doppler imaging, which has been introduced recently, seems to provide additional beneficial information during cardiovascular and general surgery. We believe that IOU should have a wider application and that surgeons and radiologists should develop cooperative working relations similar to those that exist for operative radiography.

**Ophthalmic Ultrasonography** **1105**
D. Jackson Coleman, Suzanne Woods, Mark J. Rondeau, and Ronald H. Silverman

Ultrasonic imaging of ocular structures differs from that of other organ systems because of the unique acoustical advantages of the cystlike globe and the dimensions of the important ocular tissues. These characteristics permit the use of higher frequencies than is possible in most other clinical applications.

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**Preface** ix
Theresa C. McLoud

**Clinical Overview of Occupational Lung Disease** 1121
Gary R. Epler

The workplace has been a source of lung injury for centuries, yet awareness of the types of injuries has varied over time. Because of distinctive differences among the occupational lung disorders, a continual update of the clinical findings, dose response data, physiologic characteristics, and radiographic findings is needed. The radiologist plays a key role for the evaluation of miners, foundry or factory workers exposed to mineral dusts, and of workers exposed to the "biologic" dusts, infectious agents, cancer causing agents, and chemicals causing interstitial lung diseases. This overview includes a discussion of classification systems, criteria for diagnosis of occupational lung diseases, the pulmonary clinician's evaluation, and important aspects of specific disorders and concludes with a discussion of pulmonary disability determination.

**The 1980 ILO Classification of Radiographs of the Pneumoconioses** 1135
Ralph T. Shipley

The 1980 International Labour Organization (ILO) Classification of Radiographs of the Pneumoconioses is a scheme designed for the systematic recording of radiographic changes that reflect the inhalation of dust. Its goal is to facilitate international epidemiologic comparisons through the codification of radiographic abnormalities in a simple, reproducible manner by comparison to standard radiographs. The system does not define pathologic entities but strives for a pure description of radiographs. It does not include consideration of work history or the ability to continue in a particular work environment, nor does it set a level of radiographic abnormality at which compensation is justified.

**Standard Imaging in Silicosis and Coal Worker's Pneumoconiosis** 1147
Paul Stark, Francine Jacobson, and Kitt Shaffer

Silicosis and coal worker's pneumoconiosis (CWP) are two relatively common occupational diseases. Silicosis is the most common pneumo-

coniosis in the United States. It results from inhalation of the particulate form of quartz or other crystalline forms of silicon dioxide with a diameter of less than 5 μg. CWP is the result of inhalation of carbon particles. Pathologic features of the two diseases differ, yet their radiologic features are identical. Simple pneumoconiosis is characterized by multiple small rounded opacities of 1 to 5 mm in diameter and with a bias for the upper lung zones. Complicated pneumoconiosis results from confluence of small opacities into large opacities that form conglomerate masses or progressive massive fibrosis.

**Computed Tomographic Evaluation of Silicosis and Coal Worker's Pneumoconiosis** **1155**
Martine Remy-Jardine, Jacques Remy, Isabelle Farre, and Charles Hugo Marquette

The introduction of computed tomography (CT) has modified the radiologic approach to silicosis and coal worker's pneumoconiosis considerably, allowing earlier recognition and more precise characterization of pulmonary abnormalities than chest radiography. An optimal approach to CT recognition requires an understanding of the main physiologic and pathologic features that are known to occur in both pneumoconioses. This report focuses on the most common CT features of simple and complicated forms of silicosis and coal worker's pneumoconiosis as well as on the optimal scanning protocol. The respective roles of chest radiographs and CT scans in the recognition of pneumoconiosis and follow-up of exposed workers are discussed.

**Conventional Radiography in the Diagnosis of Asbestos-Related Disease** **1177**
Theresa C. McLoud

Standard chest radiography, despite its limitations, remains an important means of evaluating the asbestos-exposed worker; it is the standard imaging procedure for the screening of asbestos-exposed populations. This article focuses on the standard roentgenographic findings associated with asbestos exposure and some of the issues and controversies in the plain film diagnosis of asbestos-related disorders.

**Computed Tomography in the Evaluation of Benign Asbestos-Related Disorders** **1191**
Catherine A. Staples

Asbestos exposure may result in the development of a number of benign conditions including pleural plaques, pleural effusion, diffuse pleural thickening, and rounded atelectasis and other fibrotic masses as well as pulmonary fibrosis. This article reviews the computed tomographic (CT) features of the benign asbestos-related pleuropulmonary diseases and the role of CT in this evaluation. The use of high-resolution CT (HRCT) and the recent HRCT-pathologic correlations in asbestosis are emphasized.

**Chronic Beryllium Disease** **1209**
Judith M. Aronchick

Chronic beryllium disease is a multisystem granulomatous disease caused by industrial exposure to beryllium dust or fumes. It is thought to represent a hypersensitivity disorder rather than a true pneumoconiosis. The lung is the primary organ of involvement, and many of the radiographic features resemble sarcoid.

**Hypersensitivity Pneumonitis** 1219
Jud W. Gurney

Hypersensitivity pneumonitis is an immunologic mediated response in the lung to inhaled organic antigen. Farmer's lung and pigeon breeder's lung are the two most widely know disorders. The chest radiograph usually is normal in hypersensitivity pneumonitis. When abnormal, the distribution of disease favors the lung bases with acute disease and the upper lung zones with chronic disease. Computed tomography (CT) may be more sensitive in detecting parenchymal abnormalities, although the characteristic findings of hypersensitivity pneumonitis at CT or high-resolution CT are nonspecific.

**Chemical Pneumonitis** 1231
Charles S. White and Philip A. Templeton

Many organic and nonorganic agents can cause chemical pneumonitis. The more soluble agents tend to involve the upper respiratory tract, and less soluble agents, the distal airways. Because the initial chest radiograph can be normal for up to 48 hours after exposure, delayed radiographs are important in determining damage.

**Occupationally Induced Neoplasms of the Lung and Pleura** 1245
Richard J. Wechsler, Robert M. Steiner, and Emily F. Conant

The relationship between asbestos and mesothelioma has been well delineated in the past. The epidemiologic, clinical, radiologic, and pathologic features of mesothelioma are discussed with reference to the diagnostic evaluation of asbestos-exposed patients. The extensive epidemiologic data correlating asbestos, tobacco smoke, and induction of lung carcinoma are also reviewed. These data provide a model for evaluation of other occupationally induced lung carcinogens such as organic and metallic industrial inhalants.

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